J. Agric. Sci. Mansoura Univ., 28(6): 4387 - 4398, 2003

EFFECT OF DIETARY BLACK CUMIN MEAL AND GARLIC ON THE PERFORMANCE OF MUSCOVY DUCKLINGS

Abd El-Samee, Laila D.

Animal Production Department, National Research Centre, Dokki, Giza, Egypt.

ABSTRACT

One hundred and eight, unsexed one-day old, Muscovy ducklings were fed a practical corn-soybean meal starter diet (21.42% CP and 2942 kcal ME/kg) during the first 14 days post-hatching. On day 15, ducklings were distributed into 6 equal groups of similar body weight; each was fed (for a10- week period) one of 6 experimental grower diets containing approximately 18% CP and 3000 kcal ME/kg. Diet 1 (control) was a corn-soybean meal basal diet. Diets 2 and 3 were the same basal diet but 30% and 60% of its soybean meal protein was replaced by black cumin (*Nigella sativa*) meal protein (BCMP), respectively. Diets 4, 5 and 6 were as diets 1, 2 and 3, respectively but with addition of 3% fresh garlic (FG). At the end of the experiment, a digestion trial was carried out on 3 male ducklings from each group, while another 4 birds from each group (two males and two females) were slaughtered to study carcass traits.

The obtained results indicated that feeding the tested materials had no significant effects on final body weight, weight gain or feed conversion. The groups fed BCMP at a replacement ratio of 60% either alone or plus 3% FG showed numerical increases in feed intake compared to the control. Dry matter, organic matter, ether extract and nitrogen-free extract digestion coefficients were not affected by treatments, but erratic differences in crude protein and crude fiber digestibilities were observed among treatments. Carcass traits were not significantly affected by treatments with the exception of a significant decrease in visceral and pad fat occurred with feeding FG; especially in combinations with BCMP. Significant differences were observed among treatments in meat composition of ducklings. Nat revenue increased with feeding the two tested materials, whereas the highest economic efficiency was achieved upon feeding the diet containing BCMP at a replacement ratio of 30% of soybean meal protein either alone or plus 3% FG, compared with that of the control.

It can be concluded that feeding Muscovy ducklings on diets containing BCMP or FG at the tested levels either alone or in combinations, resulted in an insignificant improvement in the growth performance of birds, with no adverse effects on carcass traits or meat composition, however, the dietary addition of FG reduced carcass fat.

Keywords: Black cumin meal, garlic, duck, performance, digestibility, carcass

INTRODUCTION

Consumers all over the world have became increasingly conscious of the nutritional value and the safety of their food, with an increased preference for natural food ingredients, which are generally believed to be safer, healthier and less subjected to hazards than foods containing artificial additives. So, many countries tended to prohibit the use of antibiotics as growth promoters because of their deleterious side effects on both birds and human beings. In addition, numerous studies have illustrated that medicinal plants can be used instead of chemical compounds as natural feed additives

in animal and poultry diets to improve the quantity and quality of their products.

Black cumin seed (*Nigella sativa*), as one of the important medical plants is primarily consumed to get the therapeutic benefits of its oil. Also, black cumin seed meal; after oil removal, can be used as a protein-rich meal for partial replacement of soybean meal in practical poultry diets because it possesses most of the essential amino acids at adequate amounts. Moreover, it was reported that black cumin meal can serve as a feed additive to enhance the performance of broilers (Khalifah, 1995).

Garlic (*Allium sativum*) is a worldwide plant and is used not only as a spice added to food, but also as a popular remedy. Garlic contains valuable nutrients such as vitamins, minerals, essential amino and fatty acids (Kamanna and Chandrasekhara, 1980). Garlic also has antibacterial (Nafady *et al.*, 1990; Mesbah and Abou El-Ela, 1991 and Cavallito and Baily, 1994), antifungal (Prasad and Sharma, 1981 and Nafady *et al.*, 1990), anticancerous and antioxidant (Ekram, 1972) and antiparasitic (El-Badri and Abu El-Magd, 1992; Birrenkott *et al.*, 2000; and Singh and Nagaich, 2000) properties. Hanafy *et al.* (1994) reported that garlic antagonized lead toxicity in chickens. In addition some reports demonstrated that incorporation of garlic into poultry diets suppressed lipid metabolism (Qureshi *et al.*, 1983 and Khalid *et al.*, 1995), and reduced the levels of cholesterol in the plasma (Horton *et al.*, 1991 and Galal *et al.*,1997) and in meat (Konjufca *et al.*, 1997). Because of its thyroid-like activity, garlic has been suggested to stimulate growth (El-Nawawi, 1991) and could be used as a growth promoter in broiler diets (Dey and Samanta,1993), without affecting the flavor of the cooked meat (Heath *et al.*, 1982 and 1983).

So, the present experiment was conducted to study the effects of feeding Muscovy ducklings on black cumin (*Nigella sativa*) meal; as a source of protein, to replace a part of soybean meal protein, when being used either singly or in combination with Egyptian fresh garlic, as natural growth promoters, on their growth performance, carcass characteristics, meat composition, nutrients digestibility and economic efficiency.

MATERIALS AND METHODS

This experiment was carried out, during summer months, at the Experimental Farm of Faculty of Agriculture, Cairo University, Giza, Egypt. One hundred and eight, unsexed one-day old, Muscovy ducklings were used. All ducklings were fed a practical corn-soybean meal diet containing 21.42% CP and 2942 kcal ME/kg (starter diet) during the first 14 days post hatching. During the brooding stage (the first ten days of age), the temperature was artificially maintained to be around 32 °C. After the brooding stage, ducklings were reared under the natural environmental temperature. All ducklings were exposed to 23-hour lightness (L) and 1-hour darkness (D), (23 L: 1 D), starting at day 1 till the end of the experiment. On day 15, the ducklings were distributed into 6 equal groups of 18 birds each, having similar body weights. Each experimental group was fed (for a10- week period) one of 6

experimental grower diets. Diet 1 (control) was a corn-soybean meal basal diet containing approximately 18% CP and 3000 kcal ME/kg. Diet 2 was the same basal diet but 30% of soybean meal protein was replaced by black cumin meal protein (BCMP). Diet 3 was the same basal diet but 60% of soybean meal protein was replaced by BCMP. Diet 4 was the same basal diet but with addition of 3% fresh garlic (FG). Diet 5 was the same diet 2 but with addition of 3% FG and diet 6 was the same diet 3 but with addition of 3% FG. Fresh garlic was ground daily before addition to diets 4, 5 and 6 at the tested 3% level of the daily-consumed feed. Diets and water were offered on *ad libitum* basis throughout the experimental period. All diets were formulated to meet the nutrient requirements of ducklings according to NRC (1994). Chemical analyses of black cumin meal and fresh garlic are shown in Table 1, while feed ingredients and chemical composition of the experimental diets are shown in Table 2.

Ducklings of each experimental group were weighed at the start of the experiment (day 15) and biweekly thereafter till the end of the experiment at the 12^{th} week of age. Feed consumption was also recorded biweekly. Cumulative feed conversion (grams of feed /gram gain) was calculated in 2-week intervals.

At the end of the experiment, four birds from each group (two males and two females) were randomly selected and slaughtered to determine the absolute weights and percentages of inedible and edible parts, giblets, eviscerated carcass and pad and visceral fats. All meat muscle of one side of each carcass was excised and hashed, then meat samples were taken and chemically analyzed for dry matter (DM), crude protein (CP), ether extract (EE) and ash.

Also at the end of the experiment, a digestion trial was carried out on 3 male ducklings from each group, chosen randomly, and continued on their respective diets to determine the digestion coefficients of dietary nutrients. These birds were kept individually in cages. The digestion trial included a collection period lasted three successive days during which daily records of feed consumption were maintained and the excreta voided were quantitatively collected. Proximate analyses of the expermintal diets, dried excreta and fresh meat were performed according to AOAC methods (1995).

The data of growth performance, nutrients digestibility, carcass characteristics and composition of meat were analyzed as one-way analysis of variance, according to Neter *et al.* (1985) using SAS (1996). Significant differences ($p \leq 0.05$) among means of each criterion were separated by Duncan's multiple range test (Duncan, 1955).

Table 1: Chemical analyses of black cumin meal and fresh garlic (as fed basis)

Nutrient, %	Black cumin meal	Fresh garlic
Moisture	6.37	69.92
Crude protein	33.85	7.45
Ether extract	9.95	0.76
Crude fiber	6.60	6.92
Ash	7.51	1.41
Nitrogen- free extract	35.72	13.54

Table 2: Feed ingredients and chemical analysis of the experimental diets

Ingredient, %	Starter diet	Grower diets		
		Control	30% BCMP	60% BCMP
Yellow corn	64.20	71.70	68.20	65.20
Soybean meal, 44%	25.00	16.00	9.76	3.52
Black cumin meal [1]	-	-	6.24	12.48
Wheat bran	-	1.50	5.00	8.00
Broiler concentrate [2]	10.00	10.00	10.00	10.00
Limestone	0.30	0.30	0.30	0.30
Vit. & min. premix [3]	0.30	0.30	0.30	0.30
L-Lysine HCl	0.05	0.05	0.05	0.05
DL-Methionine	0.15	0.15	0.15	0.15
Total	100	100	100	100
Determined analysis				
Moisture, %	9.72	9.40	8.52	10.28
Crude protein, %	21.42	18.27	18.22	18.09
Ether extract, %	1.67	2.68	4.73	5.15
Crude fiber, %	3.50	3.80	3.61	3.89
Ash, %	7.37	5.98	5.40	4.88
Nitrogen free extract, %	56.32	59.87	59.52	57.71
Calculated analysis [4]				
ME (kcal / kg)	2942	3012	2989	2980
Calcium, %	0.90	0.88	0.88	0.88
Total phosphorus, %	0.64	0.62	0.67	0.61
Lysine, %	1.22	1.00	0.91	0.82
Methionine, %	0.42	0.53	0.53	0.52

[1] Contained 0.27% calcium, 0.88 % total phosphorus, 1.05% lysine, 0.61% methionine and 3005 kcal metabolizable energy/kg (El-Ghamry *et al.*, 1997)

[2] Contained 52% crude protein, 3 % fiber, 7% calcium, 3.9% total phosphorus, 3.27% lysine, 1.48% methionine and 2342 kcal metabolizable energy/kg.

[3] Supplied the following per kilogram of diet: Vitamin A, 12,000 IU ; vitamin D_3, 2,000 IU ; vitamin E, 10 mg ; vitamin K_3, mg ; vitamin B_1, 1 mg; vitamin B_2, 4 mg ; vitemin B_6, 1.5 mg; vitamin B_{12}, 10 mcg; Biotin, 50 mcg ; Niacin, 20 mg; Pantothenic acid, 10, mg; Folic acid, 1 mg; Selenium, 0.1 mg; Choline Chloride, 500 mg ; Copper, 10 mg ; Iodine, 1 mg; Iron, 30 mg ; Manganese, 55 mg and Zinc, 50 mg.

[4] According to NRC (1994)

RESULTS AND DISCUSSION

Growth performance

Results of growth performance are presented in Table 3. At 2 weeks of ducklings' age (start of feeding the tested materials), body weight (BW) was similar for all groups. At the 4th week of age, BW of ducklings fed 30% BCMP alone was close to BW of those offered 30% BCMP plus 3% FG, being higher ($P \leq 0.05$) than ducklings fed 60% BCMP either alone or plus 3% FG or the control. However, at 6th, 8th and 10th weeks of age, BW was almost similar for groups fed the two levels of BCMP alone, 30% BCMP plus 3% FG or 3% FG alone, being insignificantly higher than that of the control. Similar trend was observed for the final BW at the end of the experiment, with the group fed 30% BCMP plus 3% FG showing the highest value.

Table 3: Effect of feeding black cumin meal and/or fresh garlic on growth performance of Muscovy ducklings from 2 to 12 weeks of age

Item	Control	30% BCMP	60% BCMP	3% FG	30% BCMP & 3% FG	60% BCMP & 3% FG
Age in weeks			Body weight; g*			
2	300	302	277	300	309	292
	±14	±9	±11	±8	±11	±9
4	1102^{ab}	1194^{a}	1031^{b}	1127^{ab}	1161^{a}	1042^{b}
	±45	±53	±35	±36	±51	±27
6	1840^{ab}	1958^{a}	1858^{a}	2045^{a}	1926^{a}	1672^{b}
	±94	±79	±63	±91	±73	±59
8	2452^{bc}	2708^{a}	2576^{abc}	2659^{ab}	2657^{ab}	2339^{c}
	±112	±107	±92	±108	±107	±85
10	2794	3044	2981	3015	3085	2800
	±135	±135	±132	±137	±162	±122
12	3093	3374	3364	3307	3500	3202
	±157	±167	±169	±164	±206	±159
Age intervals in weeks			Weight gain; g*			
2-4	802^{ab}	892^{a}	754^{b}	827^{ab}	852^{a}	750^{b}
	±35	±46	±26	±30	±45	±27
4-6	738^{cd}	764^{cd}	827^{bc}	918^{ab}	765^{cd}	630^{d}
	±73	±37	±41	±61	±50	±47
6-8	612^{b}	750^{ac}	718^{bc}	614^{b}	731^{ac}	667^{bc}
	±31	±38	±39	±36	±54	±43
8-10	342	336	405	356	428	461
	±33	±47	±50	±48	±63	±50
10-12	299	330	383	292	415	401
	±29	±41	±46	±46	±53	±48
2-12	2793	3072	3087	3007	3191	2910
	±157	±166	±166	±159	±201	±158
Age intervals in weeks			Daily feed intake; g/ duckling			
2-4	117	130	120	110	115	125
4-6	123	138	134	132	123	125
6-8	167	167	179	174	173	189
8-10	171	147	188	130	167	183
10-12	167	143	188	116	159	180
2-12	149	145	162	132	147	160
Age intervals in weeks			Feed conversion (feed/gain)			
2-4	2.0	2.0	2.2	1.9	1.9	2.3
4-6	2.3	2.5	2.3	2.1	2.4	2.8
6-8	3.8	3.1	3.5	4.0	3.4	4.0
8-10	7.0	6.1	6.5	5.1	5.5	5.6
10-12	7.8	6.1	6.9	5.6	5.4	6.3
2-12	3.7	3.3	3.7	3.1	3.2	3.6

*** Means in the same row without superscripts are not significantly different ($p > 0.05$), while those having different superscripts differ significantly ($p \leq 0.05$).**

On the other hand, feeding 60% BCMP plus 3% FG tended to decrease ducklings weight during the early period of the study (till the 8th week) compared to the control. This effect disappeared thereafter. Weight

gains of ducklings fed the two levels of BCMP alone, 3% FG or 30% BCMP plus 3% FG were higher than those of the control during most age intervals of the study period ($p \leq 0.05$ for 3% FG during 4-6 weeks, 30% BCMP during 6-8 weeks and for 30% BCMP plus 3% FG during 6-8 weeks). On the other hand, ducklings fed the high level of BCMP plus 3% FG showed insignificantly lower weights compared to the control during the early stage (2-6 weeks) but started to show insignificant higher values thereafter. However, when the total study period was considered (2-12 weeks), all the groups receiving BCMP or FG either alone or in combinations showed insignificantly higher weight gain relative to. the control. The insignificant improvement in ducklings' body weight gain due to the dietary inclusion of garlic may be related to its antibacterial (Cavallito and Baily, 1994), antifungal (Prasad and Sharma, 1981), antioxidant (Ekram, 1972) and antiparasitic (Singh and Nagaich, 2000) properties or the presence of other active compounds, that can improve ducklings health; and also may be related to the thyroid-like activity reported for garlic which has been suggested to stimulate the growth (El-Nawawi, 1991). The present results are in general agreement with those reported by Dey and Samanta (1993), Galal *et al.* (1997), Abdo (1998), Soliman *et al.* (1999) and El-Ghamry *et al.* (2002) who found that dietary inclusion of garlic enhanced the growth of broiler chicks. Also, in partial accordance with the present results, Zeweil (1996) found that average body weight of quails given diets containing black cumin meal to replace 15 or 30% of soybean meal protein were statistically heavier as compared to the control, while the higher levels (at replacement ratio of 60 or 75%) resulted in significantly depressed body weight gain.

Feed intake was almost similar for all groups during the different biweekly intervals of the study period with the exception of a 13.2% increase relative to the control due to feeding 60% BCMP plus 3% FG during 6-8 weeks of age, and 14.4 to 30.5% decreases relative to the control during the final 4 weeks of the experiment due to feeding 30% BCMP or 3% FG. Furthermore, when the total study period was considered, the groups fed 60% BCMP alone or plus 3% FG showed 8.7 and 7.4% increases in feed intake while those fed 3 % FG showed a 11.4% decrease compared to the control. In accordance with the present results, Galal *et al.* (1997) reported that chicks fed on a diet containing 3.6% fresh garlic had lower feed intake than those fed on a control diet. On the other hand; contradictory to the present results, feed intake of the experimental ducklings was expected to decrease with elevating the inclusion rate of BCMP in the diet, since Nigella seeds contain some alkaloids (Soliman, 1978) of bitter taste which may adversely affect the palatability of the diet.

Feed conversion was almost similar for all groups during 2 to 6 weeks of age. During 6-8 weeks of ducklings age, feed conversion improved with feeding 30% BCMP alone or plus 3% FG. Moreover, improvement in feed conversion (7.1 to 30.8%) occurred during the final four weeks of the study due to feeding the tested materials. As for the entire experimental period, ducklings fed 30% BCMP alone, 30% BCMP plus 3% FG or 3% FG alone were superior to the other groups in converting the consumed feed into gain. Khalifah (1995) reported that feed conversion was improved upon

feeding 20% black cumin meal protein replacing soybean protein. Also, El-Ghamry *et al.* (2002) found that feeding chicks on diets supplemented with 4% fresh garlic significantly improved the feed conversion.

Nutrients digestibility

Results of nutrients digestibility of the experimental diets are presented in Table 4. Dry matter (DM), organic matter (OM), ether extract (EE) and nitrogen-free extract (NFE) digestibility values did not differ significantly among treatments. A noticeable decrease in crude protein (CP) digestibility was observed upon feeding 60% BCMP either alone or plus 3% FG, but an increase in CP digestibility was occurred due to feeding 30% BCMP plus 3% FG. Even though crude fiber (CF) is of little concern as a nutrient for poultry, a noticeable decrease in CF digestibility occurred due to feeding 30% BCMP alone, with further decrease occurred when the level of BCMP was 60% either alone or plus 3% FG compared to the control. However, addition of 3% FG to the control diet or to the diet containing 30% BCMP resulted in an insignificant improvement in CF digestibility relative to the control. In accordance with the present results, Zeweil (1996) found that digestion coefficient of crude protein insignificantly decreased when black cumin meal replaced 75% of soybean meal protein in quails diet, while El-Ghamry (1998) reported that digestion coefficients of ether extract and nitrogen-free extract exhibited by laying hens fed a diet containing 6.2% Nigella seed meal were similar to those of the control. Furthermore, El-Ghamry *et al.*, (2002) reported no significant effect of feeding either 2 or 4 % fresh garlic on OM, NFE or EE digestibility in chicks.

Table 4: Effect of feeding black cumin meal and/or fresh garlic on nutrients digestibility of the experimental diets in 12-week old Muscovy ducklings

Digestibility coefficient, %	Control	30% BCMP	60% BCMP	3% FG	30% BCMP & 3% FG	60% BCMP & 3% FG
Dry matter	94.5 ±1.8	95.9 ±1.0	93.5 ±0.91	96.1 ±0.70	96.6 ±0.29	94.4 ±0.54
Organic matter	89.2 ±2.8	87.9 ±3.2	88.9 ±0.52	93.0 ±1.2	93.8 ±0.28	88.8 ±2.1
Crude protein	70.0^{ab} ±10.2	64.6^{ab} ±3.4	59.7^{b} ±2.7	73.5^{ab} ±3.5	80.3^{a} ±1.4	56.7^{b} ±6.4
Ether extract	74.7 ±6.9	74.8 ±4.6	70.7 ±7.7	75.3 ±6 9	78.8 ±1.0	68.6 ±3.1
Crude fiber	60.1^{ab} ±6.4	51.1^{bc} ±0.21	37.8^{c} ±1.7	67.3^{a} ±0.70	65.5^{a} ±0.84	41.6^{c} ±9.2
Nitrogen- free extract	87.3 ±3.1	86.0 ±3.9	85.6 ±2.3	91.0 ±1.6	90.5 ±0.49	89.7 ±0.71

Means in the same row without superscripts are not significantly different (p> 0.05), while those having different superscripts differ significantly (p≤ 0.05).

Carcass characteristics and meat analysis

Results of carcass characteristics of the experimental duckling groups are presented in Table 5. Feeding either BCMP or FG did not significantly affect carcass inedible and edible parts, measured as absolute

weights or as % of body weight (BW). Giblets weight (absolute and % of BW) was insignificantly decreased relative to the control due to feeding 30% BCMP or 3% FG, while it was increased with 60% BCMP either alone or in combination with 3% FG. Eviscerated carcass weight (g) or as % of BW increased relative to the control with feeding the tested materials with exception of 30% BCMP plus 3% FG. Visceral fat weight (g) or as % of BW was decreased due to feeding the tested materials compared to the control. Differences in visceral fat % reached significant values with 30% or 60% BCMP plus 3% FG compared to the control. Some reports demonstrated that the incorporation of garlic into chicken diets suppressed the lipid metabolism (Qureshi *et al.*, 1983 and Khalid *et al.*, 1995). Weight (g) and % of pad fat tended to decrease with feeding the tested materials. The similarity in carcass weight among treatments is due to the insignificant effect of treatments on fasting body weight. There is a strong positive relationship between fasting body weight and carcass weight (Osman *et al.*, 1994). In accordance with the present results, EL-Nawawi (1991) and Galal *et al.* (1997) found that feeding broilers on diets containing garlic did not significantly affect fasting weight, carcass weight or dressing percentage. Also, Horton *et al.* (1991) reported that, feeding dried garlic to male broilers did not influence muscle, adipose tissue and bone growth or composition.

Table 5: Effect of feeding black cumin meal and/or fresh garlic on carcass characteristics of 12-week old Muscovy ducklings.

Item		Control	30% BCMP	60% BCMP	3% FG	30% BCMP & 3% FG	60% BCMP & 3% FG
Live weight,	g	3187	3283	3483	3583	3433	3218
Inedible parts,	g	353	446	493	432	336	456
	%	11.1	13.6	14.2	12.1	12.7	14.2
		±0.6	±1.4	±1.3	±0.5	±0.9	±1.3
Giblets,	g	178	152	243	194	227	191
	%	5.6^{ab}	4.6^{b}	7.0^{a}	5.4^{ab}	6.6^{a}	5.9^{ab}
		±0.3	±0.1	±0.5	±0.8	±0.2	±0.8
Eviscerated carcass							
	g	2035	2194	2233	2383	2084	2098
	%	63.9^{ab}	66.8^{a}	64.1^{ab}	66.5^{a}	60.7^{b}	65.2^{ab}
		±1.7	±1.8	±1.8	±2.0	±2.6	±1.0
Edible parts,	g	2556	2633	2815	2911	2673	2619
	%	80.2	80.2	80.8	81.2	77.9	61.4
		±1.3	±2.2	±1.4	±0.8	±2.9	±1.3
Visceral fat,	g	84	51	72	48	17	21
	%	2.64^{a}	1.55^{ab}	2.07^{a}	1.34^{ab}	0.50^{b}	0.65^{b}
		±0.83	±0.59	±0.41	±0.32	±0.37	±0.16
Pad fat,	g	48	33	50	38	23	30
	%	1.51	1.02	1.43	1.07	0.67	0.92
		±0.27	±0.27	±0.16	±0.34	±0.42	±0.34

Means in the same row without superscripts are not significantly different (p> 0.05), while those having different superscripts differ significantly (p≤ 0.05).

Results of nutrients composition of ducklings' meat of the different experimental groups are presented in Table 6. Moisture content of the meat was decreased (P≤ 0.05) while CP content was increased (P≤ 0.05) upon

feeding 30 or 60% BCMP alone or 30% BCMP plus 3% FG compared to the control. The reverse trend was observed upon feeding 3% FG either alone or plus 60% BCMP ($P \leq 0.05$). Ether extract and ash contents of the meat were increased ($P \leq 0.05$) upon feeding 30% BCMP alone but they were decreased ($P \leq 0.05$) in the meat of duckling groups fed diets containing 3% FG either alone or plus 60% BCMP compared to the control. However, Abdo (1998) found that fresh garlic at 3% or more in broiler diets improved meat quality.

Table 6: Effect of feeding black cumin meal and/or fresh garlic on composition of meat of 12-week old Muscovy ducklings (fresh weight basis)

Nutrient, %	Control	30% BCMP	60% BCMP	3% FG	30% BCMP & 3% FG	60% BCMP & 3% FG
Moisture	73.2^{c}	71.9^{d}	72.4^{d}	76.3^{a}	72.3^{d}	75.7^{b}
	±0.17	±0.17	±0.08	±0.34	±0.07	±0.04
Crude protein	24.5^{b}	25.9^{a}	26.3^{a}	22.6^{c}	26.2^{a}	23 2^{c}
	±0.12	±0.45	±0.09	±1.53	±0.29	±0.05
Ether extract	1.3^{b}	1.7^{a}	1.2^{b}	0.8^{c}	1.1^{bc}	0.9^{c}
	±0.01	±0.18	±0.01	±0.05	±0.06	±0.04
Ash	1.3^{c}	1.5^{a}	1.2^{cb}	0.9^{d}	1.2^{b}	0.9^{d}
	±0.01	±0.06	±0.003	±0.05	±0 04	±0.04

Means within each row with different letters are significantly different ($p \leq 0.05$).

Economic evaluation

Economic evaluation of feeding Muscovy ducklings on BCMP or FG is presented in Table 7. Total and net revenue were increased and economic efficiency was improved upon feeding the tested materials; with the highest economic efficiency relative to the control, being obtained with the group fed 30% BCMP alone which had a very slight difference compared to that obtained with the group fed the diet of 30% BCMP plus 3% FG. On the other hand, the 60% BCMP plus 3% FG fed group displayed a somewhat better economic efficiency relative to the control, but was the lowest one compared to those of the other dietary treatments.

Table 7: Economic evaluation of feeding Muscovy ducklings on diets containing black cumin meal and/ or fresh garlic

Item, %	Control	30% BCMP	60% BCMP	3% FG	30% BCMP & 3% FG	60% BCMP & 3% FG
Price of Kg feed, LE	0.76	0.70	0.68	0.81	0.76	0.72
Total feed intake / duckling, kg	10.430	10.150	11.326	9.268	10.318	11.228
Feed cost /duckling, LE	7.93	7.11	7.70	7 51	7.84	8.08
Total cost /duckling, LE [1]	12.93	12.11	12 70	12.51	12.84	13.08
Final live weight / duckling, kg	3.093	3.374	3.364	3.307	3.500	3.202
Total revenue / duckling, LE [2]	27.84	30.37	30.28	29.76	31.50	28.82
Net revenue / duckling, LE [3]	14.91	18.26	17.58	17.25	18.66	15.74
Economic efficiency [4]	1.15	1.51	1.38	1.38	1.45	1.20
Relative economic efficiency [5]	100	131.30	120	120	126	104

[1] Feed cost + price of purchasing of one-day old duckling (5 LE).
[2] Selling price of duckling; was 9 LE/kg live weight.
[3] Selling price of duckling- total cost.
[4] Net revenue per unit of total cost.
[5] Assuming that economic efficiency of the control treatment representa 100%.

CONCLUSION

It is concluded that feeding Muscovy ducklings on diets containing black cumin meal and Egyptian fresh garlic each alone or in combinations had a positive effect on the performance of ducklings for weight gain and feed conversion, but the improvement was not significant. Carcass traits also were not affected greatly by dietary treatments, with the exception of a significant decrease in visceral fat occurred when garlic was fed either alone or in combinations with black cumin meal. Net revenue increased upon feeding the two tested materials but economic efficiency was the highest when black cumin meal was incorporated either alone or plus fresh garlic to replace 30% of soybean meal protein in the diet.

REFERENCES

Abdo, Z. M. A. (1998). The effect of using some natural growth promoters and fats on broiler performance and immunity. Ph. D. Thesis, Faculty of Agriculture, Cairo University.

AOAC; Association of Official Analytical Chemists (1995). Official Methods of Analysis. 16th Ed. Washington, DC, USA.

Birrenkott, G. P.; G. E. Brockenfelt; J. A. Greer and M. D. Dwens (2000). Topical application of garlic reduces northern fowl mite infestation in laying hens. Poult. Sci., 79 (11): 1575-1577.

Cavallito, J. and J. H., Baily (1994). Allicin, the Antibacterial Principle of *Allium sativum Linnaeus* Isolation, Physical Properties and Antibacterial Action. J. Am. Chem. Soc., 66

Dey, A. and A. R., Samanta (1993). Effect of feeding garlic (*Allium sativum Linn.*) as a growth promoter in broilers. Indian J. Anim. Health 32(1) 17-19.

Duncan, D. B. (1955). Multiple range and multiple F tests. Biometrics, 11:1-42.

Ekram, M. (1972). Review on chemical and medicinal aspects of *Allium sativum*. Chem. Abstr., 78:47683 (Abstr.).

El-Badri, A. A. and M. M. Abu El-Magd (1992). Occurrence of duck trichomoniasis at Qena Governorate, Egypt. Assiut Veterinary Med. J., 27(54): 257-260.

El-Ghamry, A. A. (1998). Feeding values of black cumin (*Nigella sativa*) meal and sweet lupine seeds for laying hens. J. Agric. Sci. Mansoura Univ., 23(7): 3089-3100.

El-Ghamry, A. A.; G. M., El-Mallah and A. T., El-Yamny (2002). The effect of incorporating yeast culture, Nigella sativa seeds and fresh garlic in broiler diets on their performance. Egyptian Poult. Sci., 22: (II) 445:459.

El-Ghamry, A. A.; Laila D. Abd El-Samee and M. R. M. Ibrahim (1997). Effect of feeding black cumin meal (*Nigella sativa*) meal and rice polishings at different levels on the laying performance and some blood plasma constituents. Egyptian Journal of Nutrition and Feeds 1: (Special Issue): 311-320.

El-Nawawi, G. H. (1991). Some of non conventional ingredients in broiler ration. M. Sc. Thesis, Fac. of Agric. Ain Shams Univ.

Galal, A. Gh.; A. M. A. Osman; Kh. A. Mohamed and F. M. Ayoub (1997). The use of garlic in the diets of broiler chickens. Egyptian Journal of Nutrition and Feeds. 1: 299-309.

Hanafy, M. S. M.; S. M. Shalaby; M. A. A.. El-Fouly; M. I. Abd-El_Aziz and F. A. Soliman (1994). Effect of garlic on lead contents in chicken tissues. Deutsche Tierarztliche Wochenschrift, *101 (4):157-158.*

Heath J. L.; O. P. Thomas; S. L. Owens; J. L. Nicholson and E. H. Bossard (1982). Use of wheat contaminated with garlic in broiler rations. Nutr. Abstr. Rev., 52: 5747 (Abstr.).

Heath J. L.; O. P. Thomas; S. L. Owens; J. L. Nicholson and E. H. Bossard (1983). Effect of feeding wheat contaminated with garlic to broilers. Nutr. Abstr. Rev., 53. 3792 (Abstr.).

Horton, G. M. J.; M. J. Fennell and B. M. Prasad (1991). Effect of dietary garlic (*Allium sativum*) on performance, carcass composition and blood chemistry change in broiler chickens. Can. J. Anim. Sci., 71 (3): 939-942.

Kamanna, V. S. and N. Chandrasekhara (1980). Fatty acid composition of garlic (*Allium sativum Linn*) lipids. Nutr. Abstr. Rev., 51: 2238 (Abstr.).

Khalid, Q.; L. Sultana; M. Sarwar and Y. Ahmad (*1995*). *Beneficial effects of Allium sativum Linn* in expermintal cholesterol atherosclerosis in chicken. Part II: Curative effects. PaKistan Journal of Scientific and Industrial Research, 38 (1): 11-16.

Khalifah, M. M. M. (1995). Nigella seed oil meal as a protein supplement in broiler diets M. Sc. Thesis, Faculty of Agric. Alexandria Univ.

Konjufca, V. H.; G. M. Pesti and R. I. Bakalli (1997). Modulation of cholesterol levels in broiler meat by dietary garlic and copper. Poult. Sci., 76(9): 1264-1272.

Mesbah, M. K. and Soad H. Abou El-Ela. (1991). "Garlic: A Botanical Wonder". Bull. Fac. Pharm. Cairo Univ., 29: 33-40.

Nafady, A.; T. Y. Abd El-Motelib; B. Salem and K. El-Zanaty (1990). Aspergillosis in pigeon and role of thiabendazole or garlic juice for prevention of infection. Assiut. Vet. Med. J, *22 (44): 192-197.*

Neter, J.; W. Wasserman and M. H. Kutner (1985). Applied linear statistical models regression analysis of variance and experimental designs. 2nd Ed. Richard D. Irwin, Home wood, Illions 60430.

NRC; National Research Council (1994). Nutrient Requirements of Poultry 9th Rev. Ed. National Academy Press, Washington, DC. USA.

Osman, A. M. A.; A. Gh. Galal and A. A. Saleh (1994). Comparative studies among some broiler hybrids for carcass traits and meat quality under different feeding system. Minia J. Agric. Res. & Dev., 16(2): 447-470.

Prasad, G. and V. D. Sharma (1981). Antifungal property of garlic (*Allium sativum Linn*) in poultry feed substrate. Poult. Sci., 60(3): 541-545.

Qureshi, A. A.; Z. Z. Din; N. Abuirmeileh; W. C. Burger; Y. Ahmad and C. E. Elson (1983). Suppression of avian hepatic lipid metabolism by solvent extracts of garlic : impact on serum lipids. *J. Nutri., 113 (9): 1746-1755.*

SAS, (1996). Sas user's guide for personal computers, SAS Institute Inc., Cary, NC. USA.

Singh, K. and Sh. Nagaich (2000). Studies on the anthelmintic activity of *Allium sativum* (garlic) oil on common poultry worms Ascaridia galli and Heterakis gallinae. Journal of Parasitology and Applied Animal Biology., 9 (1): 47-52.

Soliman, A. Z. M.; A. A. Ghazalah; S. H. El-Samra; A. M. Atta and Z. M. A. Abdo (1999). The synergistic effect of either black seed or garlic with fat on broiler performance and immunity. Egyptian Journal of Nutrition and Feeds. 2 (Special issue) :603-620.

Soliman, Suzann N. (1978) A pharmacognostical study of certain Nigella species growing in Egypt. MSc. Thesis, Faculty of Pharmacy, Cairo University.

Zeweil, H. S. (1996). Evaluation of substituting Nigella seed oil meal for Soybean meal on the performance of growing and laying Japanese quails. Egyptian Poult. Sci., 16: (II) 451:477

تاثير كسب حبة البركة والثوم فى العلائق على أداء البط المسكوفى

ليلى دسوقى عبد السميع

قسم الإنتاج الحيوانى ــ المركز القومى للبحوث ــ الدقى ــ الجيزة ــ مصر.

استخدم فى هذه الدراسة عدد ١٠٨ كتكوت بط مسكوفى غير مجنس عمر يوم حيث غذيت جميعها على عليقة بادئة موحدة (احتوت على ٢١,٤٢% بروتين خام، ٢٩٤٢ كيلو كالورى طاقة ممثلة/كجم) حتى اليوم ١٤ بعد الفقس ثم تم تقسيمها فى اليوم ١٥ إلى ٦ مجاميع متساوية العدد ومتشابهة الوزن بكل منها ١٨ طائر. غذيت كل مجموعة من المجاميع لمدة ١٠ أسابيع على أحد علائق النمو التجريبية (حوالى ١٨% بروتين خام، ٣٠٠٠ كيلو كالورى طاقة ممثلة /كجم) الآتية: عليقة ١ (مقارنة) وهى عليقة أساسية قوامها الذرة وكسب فول الصويا. العليقتين ٢، ٣ مثل العليقة الأساسية ولكن مع استبدال ٣٠ ، ٦٠% من بروتين كسب فول الصويا ببروتين كسب حبة البركة على التوالى. العلائق ٤، ٥، ٦ مثل العلائق ١، ٢، ٣ على التوالى ولكن مع إضافة ٣% ثوم طازج. فى نهاية فترة التجربة أجريت تجربة هضم باستخدام عدد ٣ ذكور من كل مجموعة بينما تم ذبح عدد ٤ طيور أخرى من كل مجموعة (٢ ذكور ، ٢ إناث) لدراسة مواصفات الذبيحة.

وقد أظهرت النتائج أن تغذية كتاكيت البط المسكوفى على كسب حبة البركة أو الثوم الطازج لم يؤثر جوهريا على وزن الجسم النهائى أو الزيادة الوزنية أو الكفاءة التحويلية للغذاء. زاد استهلاك البط للغذاء نتيجة التغذية على العليقة التى احتوت كسب حبة البركة بنسبة إحلال ٦٠% محل بروتين كسب فول الصويا سواء بمفرده أو مع إضافة ٣% ثوم طازج مقارنة بمجموعة المقارنة. لم تتأثر معاملات هضم كل من المادة الجافة ، المادة العضوية ، مستخلص الاثير أو المستخلص الخالى من الأزوت بالمعاملات المختلفة، ولكن ظهرت اختلافات معنوية مشتتة بين المعاملات فى النسب الهضمية للبروتين الخام والألياف الخام. زاد معامل هضم كل من البروتين الخام والألياف الخام ولكن غير معنويا نتيجة التغذية على ٣% ثوم طازج سواء بمفرده أو مع مستوى ٣٠% كسب حبة البركة. لم تتأثر صفات الذبيحة معنويا بالمعاملات باستثناء حدوث انخفاض معنوى فى كمية دهن الأحشاء ودهن البطن مع اضافة الثوم للعلائق خاصة مع استخدام كسب حبة البركة. ازداد الربح الصافى مع استخدام كل من المواد المختبرة بالنسبة لمجموعة المقارنة وكانت أعلى قيم الكفاءة الاقتصادية مع استخدام كسب حبة البركة بنسبة إحلال ٣٠% محل بروتين كسب فول الصويا سواء بمفرده أو مع إضافة ٣% ثوم.

من هذه الدراسة يمكن استخلاص أن تغذية كتاكيت البط المسكوفى على علائق محتوية على المستويات المختبرة من كسب حبة البركة أو الثوم الطازج كل بمفرده أو مجتمعين حققت تحسنا غير معنوي فى الأداء الإنتاجى للبط دون حدوث آثار سلبية على صفات الذبائح أو تركيب اللحم ، بيد أن إضافة الثوم للعلائق أدى إلى انخفاض محتوى الذبائح من الدهن.